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MOLLUSCA OF WESTERN ARKANSAS AND ADJACENT STATES, WITH A REVISION OF PARAVITREA.

BY HENRY A. PILSBRY.

Early in 1901 Mr. J. H. Ferriss explored for mollusks a portion of southwestern Missouri, western Arkansas, and some adjacent localities in the Indian Territory, the region covered lying mainly north of that exploited in 1900.[1]

The rugged topography of a portion of this region, and its elevation above the plains on all sides, have resulted in the evolution of many species and subspecies special to the tract. The general conditions of life are varied from those prevailing over the comparatively level States along the Mississippi, and with this change has come readjustment on the part of the snails. The mode of this readjustment I hope to study further when more material is available. From the data presented in this paper and my article of 1900 on the same fauna, it appears that—

(1) Species having a wide geographic range become much more variable in this district.

(2) Variation is usually *not indiscriminate, but in the large majority of individuals follows one or two definite lines of deviation* from the "normal" or widespread form.

(3) Various specific stocks show various degrees of deviation or differentiation from their widespread "normal" forms.

The first of these propositions is exemplified by a large number of species, and would be noticed by any one possessing the material for comparison. The second point is one of some importance. It is illustrated likewise by many species, of which several may be taken as examples. *Gastrodonta demissa* is a snail ranging from "Western Pennsylvania to Georgia, west to Arkansas and Eastern Texas."[2]

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[1] See Pilsbry in these *Proceedings* for 1900, pp. 449–459, and especially Ferriss, *Nautilus*, XIV, pp. 25–31, July, 1900, where the country is described, and many species not in other lists are noted. Information bearing on the molluscan fauna of adjacent districts may be found in the following papers: F. A. Sampson, "Shells of Pettis county, Mo.," in *Bull. I, Sedalia Natural History Society* (1885); "Preliminary List of the Mollusca of Arkansas," *Ann. Rep. Geol. Survey of Arkansas* for 1891, Vol. II, pp. 179–199 (1893); C. T. Simpson, "Notes on Some Indian Territory Land and Fresh-water Shells," in *Proc. U. S. National Museum*, 1888, pp. 449-454.

[2] Pilsbry, *Catal. of the Land Shells of America*, p. 28 (1898).

In this area it is not known to vary much east of the Mississippi. Several years ago I received a number of specimens from Arkansas which differed from all previously known in having the whorls so closely coiled as to make the axis quite imperforate, and at the same time the whole shell was flatter. This form I called *Gastrodonta brittsi*. Subsequently, specimens from another Arkansan locality came to my hands, in which there was a lamella within the aperture, a structure unknown in the species elsewhere. These became *G. demissa* var. *lamellata*. The abundant series collected by Mr. Ferriss since these supposed subspecies were discriminated, shows that in their area they coexist with snails indistinguishable from Eastern *G. demissa*, and that the variation of that species in this area is not indeterminate, but toward the one or the other of these two diverse modes of modification.

Polygyra monodon is in the same case. In western Arkansas, three weakly differentiated forms occur, which have been named *aliciæ*, *friersoni* and *imperforata*. All are closely related to, and doubtless descendants of, the widespread *P. m. fraterna*; and all three occur around some localities.[3] But in examining several hundred individuals I did not find the variation indiscriminate, even in a small percentage of the snails, but always toward one or the other of the three differentiation-lines signalized by the three subspecific names, without individuals intermediate between them, or otherwise modified, as the species is in some other regions.

Without further multiplying instances, I may say that while in certain districts, usually of rugged and varied topography, widespread species of snails become locally variable, there has come to my notice but little of the multifarious variation called for by the theory of natural selection. What strikes one is the uniformity with which modifications, varying in amount, yet follow definite paths.

This impression left by studies of the snails of the United States, I would never have gained from what I have seen of certain Antillean genera, such as *Cerion* or the Jamaican *Urocoptis*. In these groups there seems to be great and multifarious variation, without elimination of intermediate forms, thus making specific lines merely arbitrary.

List of Species.

Localities marked with an asterisk (*) in this list are given on Mr. Ferriss' authority.

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[3] See my former paper on Arkansan snails, *Proc. A. N. S. Phila.*, 1900, pp. 454–456, where the data on distribution are given.

POMATIOPSINÆ.

Pomatiopsis lapidaria (Say).

Seligman, Barry county, Mo.

HELICINIDÆ.

Helicina orbiculata tropica (Jan.).

Seligman,* Mo.; Petit Jean,* Yell county, Ark.

HELICIDÆ.

Polygyra leporina (Gld.).

Poteau* and Antlers,* I. T.

Polygyra dorfeuilliana (Lea).

Springfield, Green county, southwestern Missouri. Typical *P. dorfeuilliana sampsoni* Weth., 7.8 to 8.2 mm. diam. Seligman, Barry county, southwestern Missouri. Typical *P. d. sampsoni*, diam. 8–9 mm.

Chester, Crawford county, Ark. Varying from 6½ to 8 mm. diam., some specimens showing transition toward var. *sampsoni* in width of the umbilicus.

Rich Mountain, Polk county, Ark. Specimens typical, 7–7¾ mm. diam.

Hot Springs, Garland county, Ark. Like the preceding.

Carrion Crow Mountain, in Gum-dog township, Pope county, Ark. This is about ten miles north of Petit Jean Mountains. Rather heavy specimens, 6.2 to 7.6 mm. diam., with the lower lip-tooth somewhat prominent in a basal view.

Tushkahoma, I. T. The specimens vary from 6.2 to 8 mm. diam., are rather solid and somewhat more striate beneath than in typical *dorfeuilliana*. The parietal tooth is rather small. The umbilicus varies from that of typical *dorfeuilliana* to as wide as *sampsoni*, so that there is here a perfect transition between the two. A large series was collected.

Antlers, Choctaw Nation, I. T. Three specimens measuring 6, 6.2 and 7.5 mm. diam. The lip is much thickened, immersing the teeth, and the parietal tooth is unusually large and square.

In the largest shell the umbilicus is that of *sampsoni*, and the aperture less obstructed, diam. 8 mm.

Standley, Choctaw Nation, I. T. Diam. 7 to 7.5 mm., the specimens varying from *dorfeuilliana* to *sampsoni* in umbilicus. Aperture normal.

Poteau, Choctaw Nation, I. T. Rather solid, distinctly striate beneath, varying from 7.5 to 8.7 mm. diam., and from the small umbilicus of *dorfeuilliana* to the widely open condition of *sampsoni*, most of the specimens intermediate in size and umbilicus. A large series.

In some portions of southern Missouri and adjacent counties of Arkansas, the specimens are larger than typical *dorfeuilliana*, and widely open beneath, showing over one whorl. They are usually quite glossy, and rather weakly striate on the base. This form, var. *sampsoni* Weth., seems to be quite distinct in this area. In the eastern part of Indian Territory, the shells are rather heavier, more distinctly striate on the base, and wherever a large series was collected they vary from the *dorfeuilliana* form, in which but one whorl or a little less is exposed beneath, to the *sampsoni* form of base; most specimens being intermediate in these characters. This area therefore is one in which differentiation has not taken place—a transition region. Cf. these *Proceedings* for 1900, p. 449.

Polygyra jacksoni (Bland).

Springfield, Green county, and Chester,* Crawford county, Mo.; Poteau* and Rich Mountain,* Ark.

Polygyra cragini (Call).

DeKalb,* Cleburne county, Ark.; Antlers,* I. T.

Polygyra neglecta Pils.

T. fallax Say var. *minor*, Wetherby, Some Notes on American Land Shells, No. II, p. 11, in Journ. Cincinnati Soc. N. H., IV, December, 1881, p. 333.
Polygyra neglecta Pils., Nautilus, XIII, p. 40 (August, 1899).

The above reference to Mr. Wetherby's work was overlooked by me, or not recognized as pertaining to this species, when I defined *P. neglecta* in 1899. He says: "Years ago I received from Springfield, Mo., a small variety of this species [*Triodopsis fallax*], much lighter colored, with a thicker and heavier shell than the type, with the peristome reflected backward and rounded, and having a very distinct facies. I have recently received the same variety from Mr. Sampson, who collected it at Eureka Springs."

The form would hardly be recognized from this note without specimens from the localities mentioned; and as several forms of the genus have already been called "var. *minor*," it will probably not be advisable to revert to that name. Mr. Ferriss procured specimens at Seligman, Barry county, and Springfield, Green county, both in southwestern Missouri.

Polygyra inflecta (Say).

Petit Jean, Yell county, Ark.; diam. 9–11 mm. Seligman, Mo., normal specimens with strong teeth, diam. 10 mm., and a very distinct race in which the teeth are much reduced, though still the lip-teeth are decidedly stronger than in *P. edentata.* Specimens measure—

Alt. 5.3, diam. 11.5 mm.; whorls 4¾.

Alt. 5, diam. 9.5 mm.; whorls 4½.

The last whorl is somewhat more costulate behind the lip than usual in *P. inflecta.* This form may be called var. *media.*

P. inflecta was taken also at Rich Mountain,* Hot Springs* and Carrion Crow Mountain,* Ark.; Tushkahoma* and Standley,* I. T.

Polygyra edentata (Sampson).

Chester, Crawford county, western Arkansas. Two specimens sent measure 12 and 14 mm. diam., and have 5 and 5½ whorls. Eighteen were taken at this locality.

Polygyra albolabris alleni (Wetherby).

Mesodon albolabris Say, and var. *minor* A. G. Wetherby, Some Notes on American Land Shells, No. II, in Journ. Cincinnati Soc. Nat. Hist., IV, p. 11, December, 1881. Eureka Springs, Carroll county, Ark.

M. albolabris Say, F. A. Sampson, Bull. No. 1, Sedalia Nat. Hist. Soc., p. 19, 1885. Sedalia, Mo.

Mesodon albolabris Say, var. *alleni* (Wetherby) and var. *minor* Sampson, Mollusca of Arkansas, in Ann. Rep. Geol. Surv. of Ark., II, pp. 189, 190, 1893. Carroll, Benton, Sebastian, Crawford, Garland, Washington, White, Johnson, Nevada, and Independence counties, Ark.

Polygyra albolabris alleni Weth., Pilsbry, in these *Proceedings* for 1900, p. 451. Iowa and Arkansas.

All of the above references pertain, I believe, to a single widespread race of *P. albolabris,* varying in size and color almost as much as the Eastern form of the species, but in a broad view distinguishable from the latter by one, several or all of the following characters: The shell is thinner, *more depressed and more glossy;* the *spiral lines and other minute sculpture are weaker;* the lip is *narrower, rounded rather than flat,* with a weaker less angular rib within; the low basal tooth is frequently more distinctly defined. Distribution, west of the Mississippi from southern Minnesota to Arkansas, and eastward in the South to Jackson county, in northern Alabama.

In the North, *P. albolabris* replaces *alleni* east of the Mississippi river, in Illinois. I have seen typical *P. albolabris* from west of the Mississippi only from Winfield, Henry county, in southeastern Iowa, where it coexists with var. *alleni.* Owing to the frequent cutting of "ox-bows" by the Mississippi, and the consequent transfer of islands from one to the other side of the stream, even that great river is no bar to the distribution of snails inhabiting lowland forests; and somewhere along the immediate vicinity of the Mississippi the areas of *albolabris* and *alleni* probably overlap, with perhaps a belt of undifferentiated intermediate forms.

Specimens of *P. a. alleni* from Albert Lea, Minn., the most northern point from which I have seen the variety, those from Winfield, Henry county, in southeastern and Des Moines in central Iowa, are yellow or whitish, small, averaging 23 mm. in diameter; 70 per cent. of those seen measuring from 22 to 24 mm., the extreme of size being 21 and 26 mm., these extremes represented by very few specimens. I have below plotted the curve obtained from measuring the diameters of a lot of 50 specimens from Des Moines, Ia., collected by Mr. T. Van Hyning. The number of individuals is probably sufficient to afford a perfectly normal curve for the particular place these were obtained; but the specimens from Albert Lea, Minn., and Winfield, Ia., though few in number, are so similar that I would not expect much difference in their curves.[4]

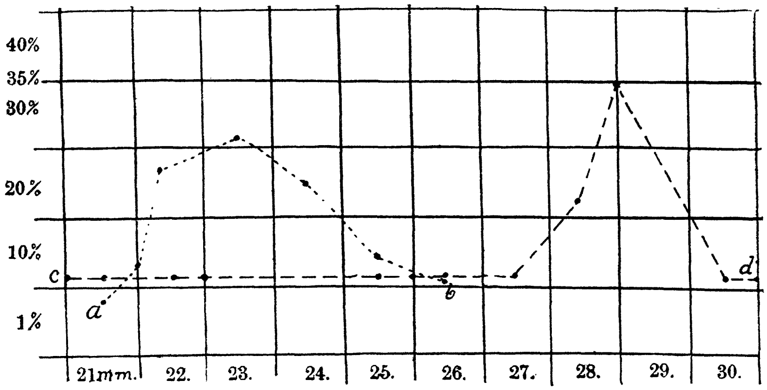

Fig. 1, *a–b*, diameter variation curve of 50 shells of ***Polygyra albolabris alleni*** from Des Moines, Ia.; *c–d*, 18 shells from Seligman, southwestern Missouri.

This contrasts strongly with the conditions in western Arkansas, southwestern Missouri and the Indian Territory, where in many localities there is a very much wider variation in absolute size. Thus, in a series of 18 shells from Seligman, Barry county, southwestern Missouri, the variation is from 20½ to 30½ mm.; the smallest being smaller than the extreme of the Des Moines lot of 50 shells, while about 70 per cent. of the shells are larger than the largest from Des Moines.

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[4] This curve is remarkably symmetrical, the average diameter of the lot, obtained by dividing the sum of their diameters by the number of specimens, practically coinciding with the diameter of the greatest number of individuals, represented by the mode or highest point of the curve. Variation in size is about equal toward both minimum and maximum. Of course it is understood that exact measurements of the shells would efface the angles of the "curve," especially near the mode. I neglected fractions smaller than ½mm., as in organisms of this size greater exactness would be mere pedantry.

A widely different condition is seen in the other curve, in which the average diameter is less than that of the greatest number of specimens. It must be constantly borne in mind that the curve of the Seligman lot is probably widely different from what a series of 50 or 100 specimens from that locality would produce; but still the absence of individuals between 22 and 25 mm. diameter, together with the fact that other localities in western Arkansas show a large and a small form, leads me to suspect that a sufficient series would form a bimodal curve, the minor mode remote from the other, and probably near the 21 mm. lien.

Of course no normal curve can be plotted from so small a series as 18 specimens; but in view of similar variation in other smaller lots, the general features of the curve are indicative of the wide range of individual variation. The specimens in the present collection from Missouri and Arkansas are as follows. There are not enough from any one place to make their variations of much significance, but I give the data for what they are worth:

De Soto, Jefferson county, Mo. A single thin, small specimen of typical *alleni*, diam. 23 mm.

Seligman, Barry county, southwestern Missouri. See notes above. Many of the specimens are large, 28 to 30½ mm. diam.

Chester, Crawford county, Ark. Three specimens measuring 30, 26 and 23 mm. diam. The smaller ones thin, like *maritima*, the larger one strong.

Hardy, Sharp county, northeastern Arkansas. Four specimens, measuring 21, 22, 24 and 26 mm. diam.

Hot Springs, Garland county, Ark. A single specimen, diam. 29½ mm., less depressed than usual.

Rich Mountain, Polk county, Ark. Rather heavy, large specimens, diam. 30 mm or more.

Carrion Crow Mountain, Pope county, Ark. Diam. 24 to 27½ mm.; rather light, with the usual narrow peristome.

Tushkahoma, Choctaw Nation, I. T. Four large specimens only, measuring 28½, 28½, 29½, 31½ mm. diam. The spire is a little higher than usual, and there are nearly 5½ whorls. The peristome is typical of *alleni*.

Standley, Choctaw Nation. A single shell similar to the above, diam. 31 mm.

In Kansas *P. alleni* occurs in Shawnee county, and at Quenemo, Osage county. The specimens resemble those from Iowa. None have been seen from southwestern Arkansas or Texas.

East of the Mississippi, specimens of typical *alleni*, resembling those of Missouri, are in the collection of the Academy from near Decherd, Franklin county, in middle Tennessee, near the Alabama boundary, received from Mr. A. G. Wetherby, and from Chattanooga, collected by Mr. S. N. Rhoads. At the latter place it coexists with a heavy form of *albolabris*, though the two do not occur together.

Polygyra albolabris fuscolabris nov.

Finally, near Woodville, Jackson county, in northern Alabama, a form was collected several years ago, by Mr. H. E. Sargent, which seems to be the culmination of the *alleni* type, with some special features which make it advisable to treat it as a local variety, under the new name *P. albolabris fuscolabris*. The shell is very large, alt. 19, diam. 34 mm., to alt. 21, diam 38 mm.; depressed, glossy and finely striate, as in *alleni* with the aperture more oblique and the lip narrower than in *albolabris* of the same size. The basal lip bears a low, flat-topped, wide tooth near the columella, and the outer lip is tinted fleshy-brown (fading in cabinet specimens). Whorls 5½.

This particular form is yet known from Mr. Sargent's collections only. A large, heavy form of *P. albolabris*, probably referable to var. *major*, also occurs near Woodville. *P. a. fuscolabris* bears such a relation to *alleni* as *major* to *albolabris*, or var. *normalis* to typical *P. andrewsæ*.

Polygyra zaleta Binn. (*exoleta* Binn.).

Seligman, Barry county, Mo. Small specimens, 20–22 mm. diam. It is in the collection of the Academy from two other localities in Arkansas: Eureka Springs (F. A. Sampson) and Mabelvale (C. W. Johnson).

Polygyra indianorum (Pilsbry).

P. divesta indianorum Pils., Nautilus, XIII, p. 39 (August, 1899). Ferriss, Nautilus, XIV, p. 28 (July, 1900).

Tushkahoma, Choctaw Nation, I. T. Five specimens 25½ to 28 mm. diam.; also Standley,* I. T. Further experience with this form convinces me that it is quite distinct from *P. divesta;* a course prompted by Mr. Ferriss. As he has collected and examined more specimens than any one else, I am the more disposed to depend upon his judgment.

Polygyra divesta (Gld.).

Pilsbry, Nautilus, XIII, p. 38 (1899).

Chadwick, Christian county, and Seligman, Barry county, Mo. In Arkansas at Chester, Crawford county; Petit Jean, Yell county; Hot Springs, Garland county; Carrion Crow Mountain, Pope county. There is but little variation in the specimens from Arkansas, all of which are typical. At Seligman, in southwestern Missouri, the size varies, the average being smaller than Arkansas shells. The smallest specimens measure 15 mm. diam., whorls 4½; the largest 18 mm. with 4¾ whorls. At Chadwick, Mo., the smallest specimens I have seen were taken, varying from 14½ to 17½ mm. diam.

Polygyra binneyana Pils.

Pilsbry, Nautilus, XIII, p. 38 (August, 1899); Proc. A. N. S. Phila., 1900 p. 451; Ferriss, Nautilus, XIV, p. 28 (July, 1900).

Poteau,* Choctaw Nation, I. T.; Rich Mountain,* Polk county, Ark.

Polygyra appressa perigrapta Pils.

Chester, Crawford county, and Petit Jean, Yell county, Ark. Specimens typical but rather small, diam. 18–19½ mm. A specimen was also sent from Gulfport, Miss.

Polygyra thyroides (Say).

Cf. Proc. A. N. S. Phila., 1900, p. 452.

Seligman, Barry county, Mo. Small specimens of the globose *bucculenta* form; diam. 15½ to 18 mm; umbilicus generally nearly covered, as in *P. clausa*, but sometimes entirely closed. The specimens have a decided resemblance to *P. clausa*. Two out of eight adults have a small parietal tooth.

Antlers, Choctaw Nation, I. T.; Poteau, in the same district, near the Arkansas boundary. Small specimens, diam. 18 mm. Carrion Crow Mountain, Pope county, also small.

At Hardy, Sharp county, in northeastern Arkansas, two specimens of a small form of *thyroides* were taken, measuring 17½ and 18 mm. diam., and closely resembling *P. clausa*, from which they differ, however, in the more "dished" lip, less elevated contour, and slight angulation of the front of the last whorl. One of these specimens is almost imperforate.

Polygyra clausa (Say).

Springfield, Green county, Mo. The specimens are quite typical. This is, so far as I know, the southwestern extreme of the known distribution of the species. Two specimens were taken at Hardy, in northeastern Arkansas. In Missouri and Arkansas *P. clausa* is sometimes very difficult to distinguish from the small form of *P. thyroides*, which occurs in that region. This is the more remarkable because the two species in other parts of the country are quite readily distinguishable by the shells.

Polygyra pilsbryi Ferriss. Pl. IX, figs. 1, 2, 3.

Ferriss, Nautilus, XIV, p. 29 (July, 1900).

Rich Mountain Station, Polk county, Ark., is thus far the only locality for this species, which in its cuticular processes is the most aberrant of the genus. The original specimens were denuded of the long filaments characteristic of the species in a fresh condition, and hence the published description did not mention them. These filaments are long, more or less curved, flexible, and arise in triangular laminæ from the narrow riblets of the surface. They stand in three principal rows on the body-whorl, one at the periphery, the others above and below it, the upper one ascending the spire midway between sutures. The inner 2½ or 3 whorls are free from filaments. The base is encircled by two minor and imperfect rows inside the subperipheral one.

In all other Stenotremes except *P. barbigera* (Redf.) the cuticular hairs form a comparatively close pile, and they are arranged in oblique sweeps, or are merely adnate and prostrate appendages trending in the direction of growth-striæ. In no other do they form a series of circular, concentric fringes. *P. barbigera* has a single fringe of similar filaments, usually persisting at the suture only.

Polygyra labrosa (Bland). Pl. IX, figs. 4, 5, 6.

Helix labrosa Bld., Ann. Lyc. Nat. Hist. of N. Y., VII, 430 (1861).
Stenotrema labrosum (Bld.), Binney, Man. Amer. Land Shells, 274.

Petit Jean Mountain, Yell county, western Arkansas; Seligman, Barry county, southwestern Missouri. Also Chester,* Hot Springs,* Carrion Crow Mountain, Ark.*

Figured for comparison with the other Southwestern Stenotremes, the figures published hitherto being in outline and quite inadequate for exact comparisons. The Tennessee specimens I have seen are more distinctly striate beneath and much paler than those from Arkansas, the aperture white. From the data now available it looks as though the range of *P. labrosa* is discontinuous, being interrupted by a wide strip of low country along the Mississippi; but its distribution in Tennessee and Alabama calls for further investigation, as no definite locality in either State is given, either in the books of Mr. Binney or on the labels of specimens from Bland in the Academy collection. Sampson has reported *P. labrosa* from eleven counties in middle and western Arkansas.

Polygyra uncifera Pilsbry. Pl. IX, figs. 7, 8, 9. 10.

P. hirsuta uncifera Pils., Proc. A. N. S. Phila., 1900, p. 453 (September 27, 1900); Ferriss, Nautilus, XIV, p. 30, No. 139*c* (1900).

Polk county, western Arkansas, at Mena and the adjacent Chastat Mountains, and Rich Mountain.

The peculiar structure of the peristome of this form certainly indicates a distinct species, and not, as I at first thought, a subspecies of

P. hirsuta. Sometimes the parietal lamella is recurved at the outer end, hook-like, as in the type (fig. 7), but in most of the specimens from Rich Mountain the recurved part is quite separate from the lamella, standing apart as a short entering denticle (figs. 8, 9, 10). I have observed no other variation of note except in the size and number of whorls, the Rich Mountain series measuring from 6.5 mm. diam. with 4⅔ whorls to 8.2 mm. with 5⅓ whorls. The "fulcrum" is quite long, as in typical *hirsuta,* and notched above and below.

Polygyra hirsuta has not been reported from Arkansas, so far as I know, and evidence is still wanting that it occurs west of the Mississippi south of Kansas and Pettis county, Mo., whence it is recorded by Sampson. I regard the specimens reported by Dr. Stearns from the "banks of Yaqui river near Guaymas"[5] as probably Eastern shells accidentally mixed with those from the locality named. The southwestern range of *P. hirsuta* is apparently much more limited than that of many of the Eastern snails.

Polygyra blandiana n. sp. Pl. IX, figs. 11, 12, 13.

Shell imperforate, depressed, *obtusely angular* at the periphery, the spire slightly convex, base much more convex, owing to the high position of the peripheral angle. Chestnut-brown; the surface rather glossy and partially dull; nearly smooth, having weak growth-wrinkles above, fainter on the base; *without hairs or their scars.* Whorls 4⅔, moderately convex, the last shortly deflexed in front. Aperture resembling, in general, that of *P. hirsuta,* but narrower; the outer end of the parietal lamina is abruptly bent inward, and its crest a little notched. The notch in the basal lip, which seems shallow in a basal view, is seen in front or oblique view to be deep, with a raised border. The outer curve of the lip is rather deeply notched. Fulcrum long, at a right angle with the aperture.

Alt. 4, diam. 8 mm.

Alt. 3.8, diam. 7 mm.

Springfield, Green county, southwestern Missouri, copiously; Seligman,* Barry county, Mo., 3 specimens.

This very distinct race differs from *P. hirsuta* in the following particulars: The shell is much more depressed and obtusely angular at the periphery; it shows no trace of hairs; the parietal lamella is more curved and stands nearer the basal lip, thereby causing the aperture to be narrower; the notch in the basal lip is larger, etc.

In a rather large series of shells, no specimens at all intermediate in characters were found.

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[5] *Proc. U. S. Nat. Mus.,* XVII, 162 (1894).

Polygyra monodon imperforata Pils.

Proc. Acad. N. S. Phila., 1900, p. 455.

Rich Mountain, Polk county, Ark. The ordinary, widely distributed *P. m. fraterna* occurs in southwestern Missouri.

Polygyra monodon aliciæ (Pils.).

Drift débris of the Arkansas river, at Petit Jean Mountain, Yell county, Ark.; Hot Springs, Ark.; DeKalb,* Ark., and Antlers,* I. T.

BULIMULIDÆ.

Bulimulus dealbatus (Say).

Seligman, Barry county, Mo. Two gray-mottled specimens collected have the spire much longer than in ordinary *dealbatus*, and the whorls, except the last two, are more strongly striate. The form approaches var. *ragsdalei* to some extent.

PUPIDÆ.

Bifidaria armifera (Say).

Seligman, Barry county, Mo.

Bifidaria contracta (Say).

Seligman, Barry county, Mo.; Rich Mountain, Polk county, Ark. The season was not a propitious one for collecting minute snails, hence their scarcity in this collection.

ACHATINIDÆ.

Cochlicopa lubrica (Müll.).

Seligman, Barry county, Mo.

CIRCINARIIDÆ.

Circinaria concava (Say)

Petit Jean,* Yell county, Ark.

ZONITIDÆ.

Vitrea hammonis (Ström).

Rich Mountain, Ark.; Seligman, Mo.

Vitrea indentata (Say).

Poteau, Tushkahoma and Antlers, I. T.; Rich Mountain, Ark.; Carrion Crow Mountain, Pope county, Ark.; Seligman, Mo.

Section PARAVITREA Pils.

Paravitrea Pils., Nautilus, XI, p. 130 (March, 1898).
Taxeodonta Pils., Nautilus, XI, p. 132 (March, 1898).

Shell depressed or discoidal, perforate or narrowly umbilicate, composed of *numerous closely coiled whorls*, usually *grooved radially* above;

thin and fragile; internally having obliquely radial laminæ, or rows or pairs of teeth, at intervals of a third of a whorl, some or all of them often wanting, especially in old individuals.

Genital system without dart sac. Radula with teeth of the central row tricuspid; two or three laterals on each side also tricuspid, the entocone raised high upon the mesocone, of which it forms a lateral spur. Marginal teeth of the usual simple and thorn-like form.

Snails of this group have the discoidal shape and *closely coiled whorls* of the typical (European) section of *Vitrea*, and they have also a dentition of the same type, which is remarkable for the peculiar mode of specialization of the lateral teeth. *Paravitrea* differs from typical *Vitrea* in the umbilicate axis and the development of teeth. The compact coiling of the numerous whorls sufficiently distinguishes *Paravitrea* from the *Hyalina* type of *Vitrea*, such as *V. hammonis*, etc.

The species of *Gastrodonta* protected by teeth, have only a single pair near the aperture, constantly added to in front and absorbed behind with growth of the shell; but in *Paravitrea* successive sets are formed to be absorbed later.

The adult or old individuals of species of *Paravitrea* usually absorb all the teeth, and form no new ones in the latest stages; or in some cases, as in *V. capsella*, teeth may be formed in occasional or rare very young individuals, while in the intermediate and later stages of growth none are developed. In a few other species, such as *V. clappi*, *V. simpsoni* and *V. placentula*, no teeth have yet been observed even in the young. If my interpretation of the facts is correct, such species as *V. andrewsæ* and *multidentata*, which commonly possess teeth in adults, are old, relatively unchanged types; while forms toothless at all stages are the most evolved. *Paravitrea thus consists of species and races in various stages of reduction and loss of teeth, but descendants from an ancestral stock which had them.*

Another modification of the ancestral radially toothed *Paravitrea* is seen in certain species in which even-edged or serrate radial ribs or lamellæ replace the rows of teeth. The irregular or serrate edge of this lamella in some individuals indicates that it has been formed by coalescence of a row of teeth, the intervals between them becoming filled up, exactly as in the *Clausiliidæ* of eastern Asia the lunella has been formed by coalescence of a primitive row of palatal plicæ.[6] In this phylum, too, the armature has been lost in some species and in some individuals of species normally toothed; and by acceleration, exceedingly rare individuals of species which normally have rows of independent teeth acquire the radial barriers of forms more advanced in the scale of evolution. This is exemplified by *V. multidentata,* discussed in a previous paper,[7] and *V. andrewsæ,* mentioned below.

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[6] See these *Proceedings* for 1901, LIII, p. 638.

All this merely goes to show that *Paravitrea* is in a condition of rapid readaptation. Mutation takes place chiefly in two definite directions: (1) *Toward progressively earlier loss of internal armature, which culminates in toothless species,* and (2) *the formation of transverse barriers by coalescence of the teeth.*

Under these circumstances, the path of the systematist is an exceptionally thorny one, although to the evolutionist the group is full of interesting suggestions. No rigorous definitions are in order; and the distinction between "species" and "subspecies"—always more or less indefinite—becomes largely a subjective one when large series of specimens are studied. Only a series of individuals representing the whole life cycle, from youth to old age, can give one an adequate idea of the characteristics of the special form from any given locality.

Through the kindness of Mr. Ferriss and others, I have been able to study large series of most of the species, in addition to the collection of the Academy.

Aside from Mr. Binney's volumes, which contain merely descriptions of part of the species discussed below, the strongest paper dealing with them is Dr. V. Sterki's *Notes on Zonitidæ.*[8] The fact that *Zonites andrewsi* and the Eastern form commonly known as *significans* have few teeth or none when adult is set forth, and the author shrewdly suggests that these two forms may be the young of *Z. placentulus* and *capsella* respectively. Dr. Sterki worked from small series of specimens from a few localities, and with much more ample material it is easy now to criticise his solution of the difficult problem; but he saw further into the relationships of these forms than any writer up to that time. My former course in separating the species into two sections, one of which (*Taxeodonta*) was placed under *Gastrodonta,* was a step backward. No such arrangement would have been entertained had I examined the dentition. In *Gastrodonta* the lateral teeth are more numerous than in *Vitrea* or *Paravitrea,* and conspicuously different in shape.

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[7] These *Proceedings* for 1900, p. 145.

[8] *Nautilus,* VII, pp. 13-17, June, 1893. It may be as well to note here that the *Gastrodonta* described by him under No. 3 (p. 14) is what I described as *G. collisella.* His No. 6 (p. 15) is apparently *G. cœlaxis.*

Key to average or normal specimens of Paravitrea.

I.—Surface closely and regularly rib-striate or grooved, at least above; umbilicus minute.

- *a.*—Diam. 5–6.5 mm.; spire flat or slightly convex, the suture deep; 6½ convex, narrow whorls, subregularly and deeply grooved radially, above and below. Umbilicus minute. No internal teeth, ... *V. clappi.*
- *a'.*—Diam. 2.5 to 3.5 mm.; very closely rib-striate above; whorls 5½–6, closely coiled, the spire but slightly convex.
  - *b.*—One to three radial rows of 5 or 6 teeth each, visible through the base, ... *V. multidentata.*
  - *b'.*—One to three radial curved barriers, visible through the base; surface not striated spirally; width of umbilicus about one-tenth that of the shell, . . *V. lamellidens.*
  - *b''.*—With barriers like the preceding species, or none; surface finely striate, the striæ decussated by very minute spirals; umbilicus wider, its diameter contained about 5½ times in that of the shell, ... *V. walkeri.*

II.—Surface sculptured with spaced, unequal radial grooves, more conspicuous above.

- *a.*—Diam. of adults 5 to 6 mm.; toothless or with teeth in pairs.
  - *b.*—Periphery median; aperture usually crescentic. Eastern forms.
    - *c.*—Shell toothless, ... *V. capsella.*
    - *c'.*—Shell with internal pairs of teeth, . *V. c. lacteodens.*
  - *b'.*—Western forms (Missouri, Arkansas, Indian Territory), with the aperture subtriangular.
    - *c.*—Young usually toothed; adults dome-shaped, with subbasal periphery, ... *V. significans.*
    - *c'.*—Not toothed; adults discoidal, . . . *V. simpsoni.*
- *a'.*—Diam. of adults 7 to 7½ mm.; toothless or with 1 to 5 teeth in each row.
  - *b.*—No teeth at any stage of growth; *whorls* 7 *to* 7½, *V. placentula.*
  - *b'.*—Teeth developed in young shells, persisting or absent in adults; shell very fragile; *whorls* 8 *to* 8½, *V. andrewsæ.*

Vitrea clappi (Pils.). Pl. X, figs. 1, 1*a*, 1*b*, 8, 8*a*.

> *Gastrodonta clappi* Pils., Nautilus, XII, p. 86 (December, 1898); XV, p. 37, Pl. 2, figs. 8, 9 (August, 1901); Proc. Acad. Nat. Sci. Phila., 1900, p. 144. Ferriss, Nautilus, XII, p. 99; XV, p. 58.

Range: Great Smoky Mountains, along the Tennessee-North Carolina boundary range from Thunderhead and Blockhouse Mountains to the Big Pigeon river.

The type locality is Miry Ridge. The type (Pl. X, figs. 1, 1*a*, 1*b*), with a diameter of 5.5 mm., has a minute umbilicus, about .2 mm. wide, and the spire of 7 whorls is convex. In all other specimens seen the spire is lower, either flat or but slightly convex; and with one exception, all have the same minute umbilicus. In one specimen, from Clingman Dome, No. 2,490 of the collection of Mr. George H. Clapp (Pl. X, figs. 8, 8*a*), the umbilicus is decidedly larger, .6 mm. wide, the shell having a diameter of 6.2 mm., with 6½ whorls. Whether this is an individual variation or the representative of a race of more widely umbilicate shells, remains to be determined.

In 1900 Mr. Ferriss traced this beautiful and excessively rare species far to the northeast of the original locality, taking specimens at Mt. LeConte, and at Indian Gap and Newfound Gap on the Big Pigeon river.

Vitrea lamellidens (Pils.). Pl. X, figs. 2, 3, 3*a*, 3*b*.

Gastrodonta lamellidens Pils., Nautilus, XI, p. 134 (April, 1898); Proc. Acad. Nat. Sci. Phila., 1900, p. 145. Ferriss, Nautilus, XII, p. 99; XIV, pp. 52, 58. Walker and Pilsbry, Proc. Acad. Nat. Sci. Phila., 1902, p. 437.

Range: Great Smoky Mountains, along the Tennessee-North Carolina boundary, from the Little Tennessee river to Thunderhead Mountain (the type locality), and eastward in Graham county, N. C.; also in the Black Mountain range at Bluff Mountain and Pinnacle of the Blue Ridge.

Similar to *V. multidentata,* but armed within with curved, obliquely radial barriers instead of rows of teeth, and having a narrower umbilicus, its width contained about 10 times in that of the shell, while in *multidentata* it is contained only about 6 times.

In about 150 individuals collected in 1899 and previously, which I examined, all had from one to three lamellæ; but a very large shell, diam. 3.8 mm., found by Mr. Ferriss on Thunderhead in 1900, has no lamellæ whatever—a feature of senility. Even in the youngest individuals I have seen, such as Pl. X, fig. 2, diam. 1.4 mm., there are two or three barriers, though one would expect rows of teeth in so early a stage. Not one *V. multidentata* has yet been found with *lamellidens,* which lives mainly in the moist heights, where the mountains lift their heads into the clouds. We did not find it in the "coves" below.

Vitrea multidentata (Binney). Pl. X, figs. 6, 6*a*.

W. G. Binney, Man. Amer. Land Shells, p. 183 (1885).

The southernmost locality is Talassee Ford of the Little Tennessee river, whence Mr. Ferriss reports it.[9]

Figured for comparison with the preceding and following species. With ordinary specimens of *multidentata* there sometimes occur shells in which radial barriers similar to those of *V. lamellidens* replace the teeth of the normal form. Such specimens are known from West Granby, Hartford county, Conn.; Garrettsville, O. (Pl. X, fig. 7); Greenwich, N. Y. (Acad. Coll.); Deering, N. H.; Litchfield, N. Y. (Coll. G. H. Clapp); Ottawa, Can. (Coll. Bryant Walker),[10] and Ithaca, N. Y. (Coll. H. E. Sargent). In the adult specimens I have seen, like that figured (diam. 3 mm.), the umbilicus is about as wide as in *multidentata*. In those examined by Mr. Clapp it is narrower, as in *lamellidens;* but his shells are not full grown, measuring only 2 to 2.5 mm. in diameter. From the occurrence of this form as rare single specimens, always with typical *multidentata,* I am still disposed to look on the specimens as accelerated individuals, sporadically occurring—the pioneers of a new race, further advanced in evolution than *multidentata*. If my view is correct, this race of the future will be parallel to *lamellidens,* which has in the past undergone a like transformation.

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[9] Nautilus, XIV, 58.

A view apparently much simpler is held by Mr. Clapp, who regards the Northern specimens with continuous barriers as really *V. lamellidens,* which in this view has an extensive range north to Canada.

Vitrea walkeri (Pilsbry). Pl. X, figs. 4, 4*a*, 5.

Gastrodonta walkeri Pils., Proc. Acad. Nat. Sci. Phila., 1900, p. 146. Ferriss, Nautilis, XIV, pp. 52, 58.

Range: Great Smoky Mountains, in Graham county, N. C., and Monroe county, Tenn.

This form is about the size of *V. multidentata,* ordinarily measuring about 2.9 mm., with 5½ to 5¾ whorls, and an umbilicus contained about 5½ times in the diameter of the shell, much as in *multidentata*. It is either toothless or has radial barriers of the *lamellidens* type, but the wider umbilicus and minutely decussate surface readily separate the species from *lamellidens*.

No specimens have turned up since our expedition of 1899, and it remains one of the rarest of land snails. Figs. 4, 4*a* represent a shell from Tuskeegee Mountain; fig. 5 a specimen from Talassee Ford of the Little Tennessee river.

Vitrea andrewsæ (W. G. Binney). Pl. XI, figs. 9, 9*a*, 10, 11, 11*a*, 11*b*.

Zonites andrewsi W. G. B., Ann. N. Y. Acad. Sci., I, p. 359, Pl. 15, fig. D (1879); [First] Supplement to Terr. Moll., V, p. 144, Pl. 2, fig. D (reprint from Ann. N. Y. Acad.); Man. Amer. Land Shells, p. 228, fig. 251. Sterki, Nautilus, VII, p. 16 (1893).

Gastrodonta andrewsæ W. G. B., Walker and Pilsbry, Moll. of Mt. Mitchell Region, N. C., in Proc. Acad. Nat. Sci. Phila., 1902, p. 437.

Range: Roan Mountain (type locality) to Paint Rock on the French Broad river, and eastward to the Black Mountains, N. C.

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[20] *Ottawa Naturalist,* XIV, p. 94, 1900. A single specimen of "lamellidens" with *multidentata,* collected by Gilbert Heron, is recorded by Mr. Walker.

Shell similar to *V. placentula* in general form and size, but the whorls increase more slowly, the last being narrower; thin and fragile, often sprinkled with buff dots. Teeth generally present, 3 to 5 being arranged in a radial row, or with several such rows within the basal wall, though the number of teeth may vary down to 0 in the adult stage, or less frequently at any stage of growth. Whorls 8 to 8½ in adults, which measure 7 to 8 mm. diam.

In some localities, as around Roan Mountain, teeth are almost invariably developed. In some other localities they are rare in adult shells, and developed in the young ones only. Such toothless individuals are separable from *V. placentula* by their slightly more fragile structure and greater number of narrower whorls.

In a multitude of shells examined from over a dozen localities, I found one young specimen with a diameter of 4 mm. in which there was a single radial barrier, such as occurs in *V. lamellidens* Pils.[11] The figures are from topotypes.

Vitrea placentula (Shuttleworth). Pl. XI, figs. 1, 1*a*, 1*b*.

Zon. placentulus Shuttl., Sterki, Nautilus, VII, p. 17 (1893).
Vitrea capsella placentula Shuttl., Pils., Proc. Acad. Nat. Sci. Phila., 1900, p. 140.

This species, if such it be, differs from *V. capsella* merely in the larger size, and in having an additional whorl. Adult shells measure 7 mm. diam., and have 7 or 7½ whorls. I have never seen a specimen with teeth, although a good many shells, adult and young, from the Great Smoky Mountains and elsewhere have passed under my lens; but when very young individuals of *placentula* are found, I think they will prove to have pairs of teeth, at least in rare cases, as in *capsella*. It is a trifle more solid than *V. andrewsæ* (W. G. B.), and in specimens of the same size the latter has a whorl more. The range of *V. placentula* lies to the southwest of that of *V. andrewsæ*. It was not taken by Ferriss and Walker in the valley of the French Broad river, nor in the Black mountains. Sterki's suggestion that *andrewsæ* is the young of *placentulus* is not borne out by the facts now known. Over a large part of the range of *placentula, V. andrewsæ* does not occur.

The figured specimen is from Philadelphia, Loudon county, Tenn.

Vitrea capsella (Gld.). Pl. XI, figs. 2, 3, 4, 4*a*, 4*b*.

Zonites capsella Gld., W. G. Binney, Man. Amer. Land Shells, p. 221.

The type locality of this species is "Tennessee." Two specimens so labelled, presumably from the original lot, are in the collection of the Academy, given by Gould.

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[11] This specimen is No. 16,963 of Mr. Bryant Walker's collection, taken by him at Paint Rock, N. C., on the south side of the French Broad river, near the Tennessee boundary.

The species differs from *V. significans* chiefly in the different contour of the adult shell; from *V. placentula* in the smaller size of the adults. The shell measures from 5 to nearly 6 mm. in diam., and has 6 to 7 whorls. Rarely, a young individual may be found with a pair or two of internal teeth (Pl. XI, fig. 3, diam. 2 mm.), recalling the ancestral dentate stock; but this stage is now passed through at an early age, or entirely skipped; and in the series I have examined, from southwestern Virginia, Kentucky, Tennessee and Alabama, toothed individuals are very unusual.

V. capsella is not known from west of the Mississippi depression, being represented there by the very closely related *V. significans* and *V. simpsoni.* The figures represent specimens from Woodville, Ala., collected by Mr. H. E. Sargent.

Vitrea placentula and *significans* might, with no great violence, be subordinated to *capsella* as subspecies.

Vitrea capsella lacteodens n. v. Pl. XI, figs. 5, 5*a*.

Hyalina significans Bld., Harper, Journ. Cincinnati Society of Natural History, IV, 1881, p. 258, figs. 2, 2*a*.

Zonites significans Bld., Wetherby, Journ. Cin. Soc. N. H., IV, December, 1881, p. 328, No. 25. W. G. Binney, Man. Amer. Land Shells, p. 228, fig. 250 (exclusive of quotation from Bland, etc.). Sterki, Nautilus, VII, pp. 16, 17 (1893).

Gastrodonta significans Bld., Pilsbry, Moll. of the Great Smoky Mts., Proc. Acad. Nat. Sci. Phila., 1900, p. 147.

Vitrea capsella, specimens from Tuskeegee Mountain, Graham county, N. C., Pilsbry, *t. c.*, p. 140.

Type specimens from "Ramp Cove," Tuskeegee Mountain, N. C., taken by James H. Ferriss and H. E. Sargent, 1899.

The shell is similar to *V. capsella*, except that most specimens have one to three pairs of tubercular teeth within the last whorl. The sutures are a trifle less impressed, and the striation perceptibly closer. It differs from *V. significans* in the usual persistence of the teeth in the adult stage, and the median position of the periphery. In fully adult *significans* the periphery is subbasal, and there are no teeth.

Alt. 2.6, diam. 5 mm.; whorls 6½.

This particular race occurs, so far as I know, only in the mountains of southwestern North Carolina. It is not separable from *V. capsella* by any hard-and-fast character, but merely by the persistence of the pairs of teeth in most adult shells of any given lot. Thus in the type lot, collected by Mr. Sargent on Tuskeegee Mountain, Graham county, N. C., one adult out of thirteen before me is quite toothless, and by itself would be called *capsella.* Some others have only one or two teeth remaining. It is the general character of the specimens from any one place, not the particular condition of each individual, that must be considered.

Harper, Wetherby, W. G. Binney and Sterki have mistaken this race for the Western *V. significans,* and I formerly followed this erroneous identification.

Vitrea significans (Bld.). Pl. XI, figs, 7, 7*a*, 7*b*, 8, 8*a*.

Helix significans Bld., Amer. Journ. of Conch., II, p. 372, Pl. 21, fig. 9 (not good).
Zonites significans Bld., Binney, *op. plur.*, exclusive of East Tennessee form.

Range: Originally described from Fort Gibson, Indian Territory, this species has been taken to my knowledge in Arkansas, at Mabelvale (C. W. Johnson[12]), and in southwestern Missouri, at Seligman, Barry county (Ferriss, 1901).

As Bland stated in his original description, the young shells are sometimes provided with one or two pairs of tubercular teeth within, visible through the base of the shell as white spots. The full-grown shells are toothless, more or less dome-shaped, the periphery being situated below the middle of the last whorl, the circumference of which is flattened and sloping. The base is very concave in the middle. This gives the shell a peculiar and unusual contour. Half-grown and young individuals are normal in shape, and very similar to *V. capsella* and its variety *lacteodens,* from which, indeed, it would be almost impossible to separate them except by the locality. The spire, seen from above, is about the same in *capsella, placentula* and *significans.* Figs. 7, 7*a*, 7*b* represent fully adult specimens of the typical form from Seligman, Barry county, Mo., collected by Mr. Ferriss; figs. 8, 8*a* are immature shells from the same place and lot.

Vitrea simpsoni (Pilsbry). Pl. XI, figs. 6, 6*a*, 6*b*.

Zonites capsella Gld., Simpson, Proc. U. S. Nat. Mus. for 1888, p. 452.
Zonites simpsoni Pils., These Proceedings for 1889, p. 412, Pl. 12, figs. 8–10.
Vitrea simpsoni Pils., These Proceedings for 1900, p. 456; Ferriss, Nautilus, XIV, pp. 30, 31.

Range: Western Arkansas and Indian Territory; Mena and Hatton's Gap, Polk county, in western, Morris Ferry, Little River county, southwestern Arkansas (J. H. Ferriss); Limestone Gap, I. T. (C. T. Simpson).

This species is more depressed than *significans* or *capsella,* with *the last whorl decidedly wider,* when viewed from above. It has not yet been found with teeth, but so far only small numbers have been taken. The type is figured.

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[12] Reported in the *Catalogue of Land Shells,* 1898, p. 26, under *V. simpsoni,* No. 275.

Zonitoides minusculus (Binn.).

Seligman, Barry county, Mo.

Zonitoides arboreus (Say).

Poteau, Tushkahoma, and Antlers, I. T.; Seligman, Mo.

Gastrodonta demissa (Binney).

Carrion Crow Mountain, Pope county, Ark. Twenty-one specimens, most of them narrowly perforate, with a very heavy internal callus; four have a low lamella, and one is imperforate. They therefore unite characters of the varieties *lamellata* and *brittsi,* like those from other places in their same general region. Cf. these *Proceedings* for 1900, p. 456.

At Hot Springs, Garland county, Ark., *G. demissa brittsi* was taken, a few of the specimens having an internal lamina.

Various forms of *demissa* were taken at Poteau* and Tushkahoma,* I. T., and Rich Mountain,* Ark., reported by Mr. Ferriss.

ENDODONTIDÆ.

Pyramidula solitaria (Say).

Reported from Rich Mountain, Polk county, Ark., by Mr. Ferriss.

Pyramidula alternata (Say).

Typical specimens at Petit Jean, Yell county, Ark., and Seligman, Mo., and Standley, Choctaw Nation, I. T. Also reported by Ferriss from Rich Mountain and Hot Springs, Ark.

Pyramidula perspectiva (Say).

Reported by Ferriss from Seligman, Mo.; Petit Jean and Rich Mountain, Ark.

Helicodiscus lineatus (Say).

Seligman, Barry county, Mo.

SUCCINEIDÆ.

Succinea avara Say.

Seligman, Mo.; Rich Mountain, Ark.

LIMNÆIDÆ.

Limnæa columella Say.

Winding Stair Mountain, I. T.

EXPLANATION OF PLATES IX, X, XI.

PLATE IX, Figs. 1, 2, 3.—*Polygyra pilsbryi* Ferriss. Topotype.

Figs. 4, 5, 6.—*Polygyra blandiana* Pils. (*Helix labrosa* Bland, not Wood). Type. Petit Jean Mountains, Yell county, Ark.

Fig. 7.—*Polygyra uncifera* Pils. Cotype. Mena, Polk county, Ark.

Figs. 8, 9, 10.—*Polygyra uncifera* Pils. Rich Mountain, Polk county, Ark.

Figs. 11, 12, 13.—*Polygyra blandiana* Pils. Cotype. Springfield, Green county, Mo.

PLATE X, Figs. 1, 1*a*, 1*b*.—*Vitrea clappi* Pils. Three views of the type. Miry Ridge, Great Smoky Mountains.

Fig. 2.—*Vitrea lamellidens* Pils. Young individual from Thunderhead, diam. 1.4 mm. No. 77,752 A. N. S. P.

Figs. 3, 3*a*, 3*b*.—*V. lamellidens*. Thunderhead. Diam. 3.5 mm. No. 77,752 A. N. S. P.

Figs. 4, 4*a*.—*V. walkeri* Pils. Front and basal views of the type.

Fig. 5.—*Vitrea walkeri* Pils. Base of shell from Talassee Ford. No. 77,703 A. N. S. P.

Fig. 6, 6*a*.—*Vitrea multidentata* Binn. Basal and front views of a typical specimen from West Granby, Hartford county, Conn. No. 57,104 A. N. S. P.

Fig. 7.—*Vitrea multidentata* Binn. Base of a specimen with the teeth united into an even barrier. Garrettsville, O. No. 66,858 A. N. S. P.

Figs. 8, 8*a*.—*Vitrea clappi* Pils. Openly umbilicate specimen from Clingman Dome. No. 2,490 Coll. G. H. Clapp.

PLATE XI, Figs. 1, 1*a*, 1*b*.—*Vitrea placentula* Shuttl. Philadelphia, Loudon. county, Tenn. No. 5,490 A. N. S. P.

Fig. 2.—*Vitrea capsella* Gld. Half-grown shell, diam. 3 mm. Woodville, Ala. No. 68,820 A. N. S. P.

Fig. 3.—*Vitrea capsella* Gld. Young specimen with two pairs of internal teeth, diam. 2 mm. Woodville, Ala. No. 68,820.

Figs. 4, 4*a*, 4*b*.—*Vitrea capsella* Gld. Adult from Woodville, Ala., diam. 4.5 mm. No. 68,820 A. N. S. P.

Figs. 5, 5*a*.—*Vitrea capsella lacteodens* Pils. Tuskeegee Mountain, Graham county, N. C., No. 77,798 A. N. S. P.

Figs. 6, 6*a*, 6*b*.—*Vitrea simpsoni* Pils. Type. Limestone Gap, I. T. No. 61,676 A. N. S. P.

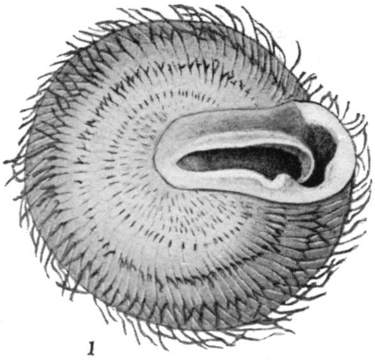
Figs. 7, 7*a*, 7*b*.—*Vitrea significans* Bld. A fully adult specimen from Seligman, southwestern Missouri. No. 81,446 A. N. S. P.

Figs. 8, 8*a*.—*Vitrea significans* Bld. Young shell with internal teeth, diam. 3.8 mm. Same locality.

Figs. 9, 9*a*.—*Vitrea andrewsæ* W. G. B. Half-grown shell from Roan Mountain, N. C., diam. 4.5 mm.

Fig. 10.—*Vitrea andrewsæ* W. G. B. Younger shell, diam. 3 mm.

Figs. 11, 11*a*, 11*b*.—*Vitrea andrewsæ* W. G. B. Adult, Roan Mountain, N. C. No. 67,577 A. N. S. P. This and figs. 9, 9*a* and 10 are from specimens of the original lot, collected by Mrs. George Andrews.



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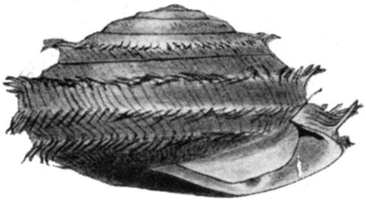

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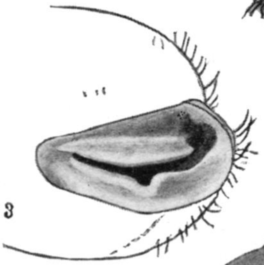

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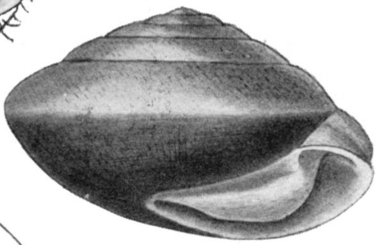

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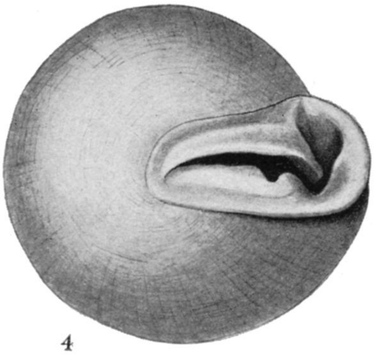

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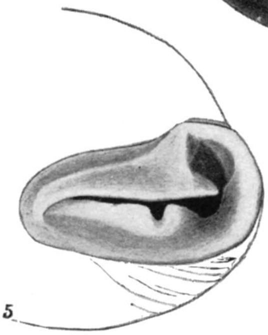

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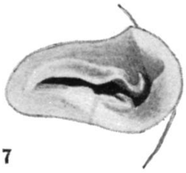

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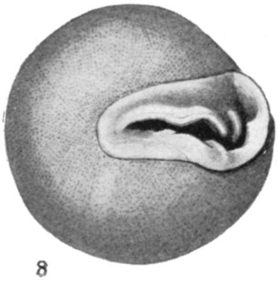

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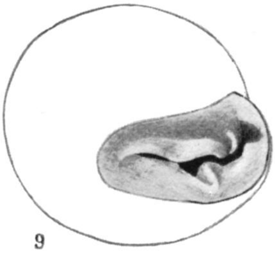

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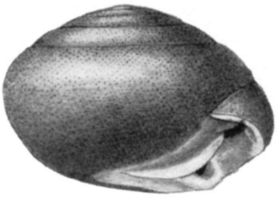

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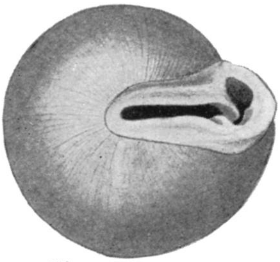

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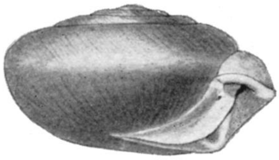

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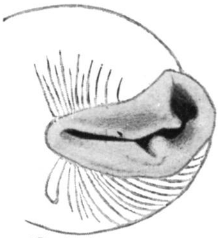
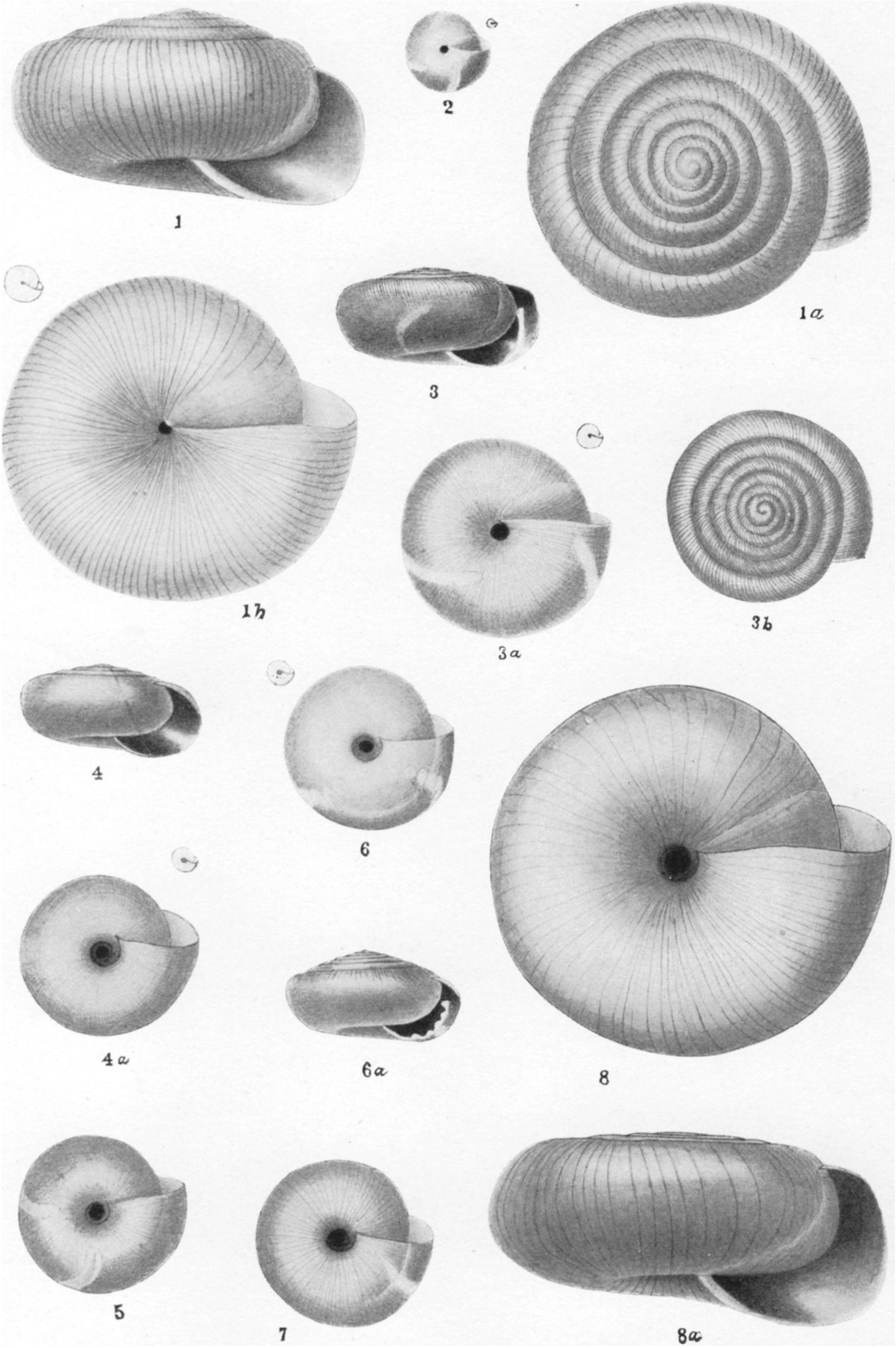
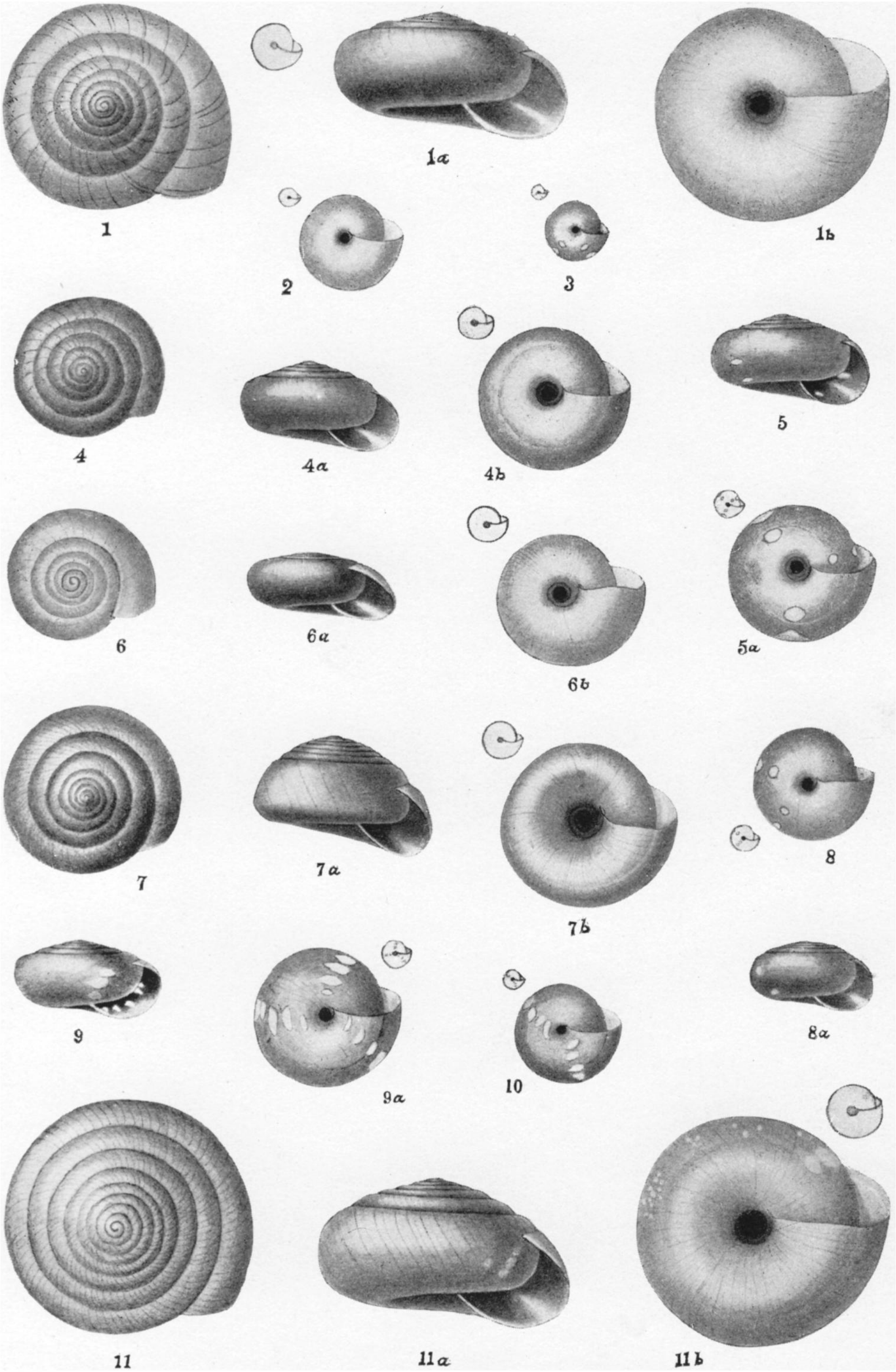


13

PILSBRY. MOLLUSCA OF WESTERN ARKANSAS, ETC.



PILSBRY. MOLLUSCA OF WESTERN ARKANSAS, ETC.



PILSBRY. MOLLUSCA OF WESTERN ARKANSAS, ETC.